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Software for Reliability Analysis

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Additional information is available at the end of the chapter

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This short overview gives only some of the commercial programs for reliability assessment. They range from simple ones at moderate prices and suitable for a limited range of problems to program systems for the analysis of complex problems. For getting practice and for the solution of simple problems, the reader can create own programs based on universal software such as Excel, although their possibilities are limited.

VaP – Variables Processor (<http://www.petschacher.at>)

A simple Monte Carlo simulation program VaP enables the probabilistic analysis of a user-defined function $G(x)$ depending on one or more random input variables. Several types of probability distributions can be used. VaP calculates the expected value, standard deviation, skewness, and curtosis of G . It shows the histogram of the function G and calculates the probability that G gets less than zero. (The program was originally developed for the students of civil engineering at ETH, with G denoting reliability margin, cf. Chapter 14, and can also use the First Order Reliability Method FORM.) The main results are saved and printed. Favorable price-performance ratio.

Anthill(<http://www.sbra-anthill.com>)

Anthill is a computer program for the calculation of reliability and other statistical analyses based on the Monte Carlo method. The user-defined model for analysis can use various mathematical and logical functions and predefined histograms. After the trials with random values of input quantities have been performed, a statistical analysis of sampled values is performed, and the results are displayed. The resulting histograms and statistical parameters can be saved for further postprocessing. Favorable price-performance ratio.

Feasible Reliability Engineering Tool (FReET) (<http://www.freet.cz>)

FReET is a multipurpose probabilistic software for statistical, sensitivity, and reliability analysis of engineering problems, developed at the Brno University of Technology, Institute

of Structural Mechanics. It allows the simulation of random uncertainties in various problems, especially in civil and mechanical engineering (material properties, loading and geometrical imperfections). It uses the following probabilistic techniques: crude Monte Carlo simulation, Latin hypercube sampling, simulated annealing, first-order reliability method (FORM), and others. Favorable price-performance ratio.

Strurel (<http://www.strurel.com>)

Strurel is a set of programs for the reliability analysis of constructions (especially in civil engineering). It consists of three programs: Statrel (reliability-oriented statistical analysis), Comrel (time-invariant and time-variant analysis), and Sysrel (a program for system reliability analysis). It can work with analytical functions and performs reliability analysis using various methods, such as Monte Carlo or FORM and SORM (first-order or second-order reliability methods), used for the solution of the problems of load-resistance type.

In addition to the above software, oriented mostly on the determination of failure probability of one component or construction, also software systems exist, which use various tools and enable comprehensive reliability analysis of very complex objects, such as aircrafts or weapon systems. Here, four brands will be mentioned.

Item Software (<http://www.itemsoft.com>)

This software firm (USA) offers various products, such as ITEM ToolKit. This is a suite of several analytical and reliability prediction modules in one integrated environment, such as

MIL-HDBK-217 module. A reliability prediction program based on the internationally recognized method of calculating electronic equipment reliability defined in military handbook MIL-HDBK-217 (published by the U.S. Department of Defense).

IEC 62380 Electronic Reliability Prediction module. It supports reliability prediction methods based on the latest European reliability prediction standard IEC.

NSWC Mechanical Reliability Prediction module. It uses a series of models for various types of mechanical devices including actuators, springs, bearings, seals, electric motors, pumps, compressors, brakes, and clutches to predict failure rates based on temperature, stresses, flow rates, and various other parameters. The module is based on the Naval Surface Warfare Center Handbook of Reliability Prediction Procedures for Mechanical Equipment.

China 299B Electronic Reliability Prediction module: A reliability prediction program based on the internationally recognized method of calculating electronic equipment reliability provided in the Chinese Military/Commercial Standard GJB/z 299B.

Telcordia Electronic Reliability Prediction module: Based on the Telcordia (Bellcore) TR-332 and SR-332 standards, calculates the reliability (steady-state failure rate) for various categories of electronic, electrical, and electromechanical components for various quality levels, environmental conditions, electrical stress conditions, and other parameters.

In addition to these modules, the ITEM ToolKit contains several other modules, for example for failure modes, effects, and criticality analysis (FMECA); for fault tree analysis (FTA); for

construction of reliability block diagrams (RBD); for Markov analysis; and for maintenance and others.

ReliaSoft (<http://www.reliasoft.com>)

This U.S. software firm offers a group of programs in one integrated environment, such as Weibull \pm [®] for reliability analysis; ALTA[®] for Accelerated Life Testing Data Analysis; DOE \pm [®] for design of experiments; BlockSim[®] for the creation of reliability block diagrams based on fault tree analysis; RENO[®] simulation software for risk and decision analysis; Xfmea[®] – software for facilitating data management and reporting for all types of FMEA and FMECA; RCM \pm [®] – software for the support of reliability-centered maintenance; Lambda Predict[®] – for reliability assessment based on standards; RBI[®] – risk-based inspection analysis for oil, gas, chemical, and power plants in adherence to the guidelines presented in the American Petroleum Institute's publications API RP 580 and RP 581, as well as the American Society of Mechanical Engineers ASME; XFRACAS[®] – software system for web-based incident/failure/data reporting, analysis, and corrective action; and RGA[®] – software for the analysis and support of reliability growth.

Isograph (<http://www.isograph.com>)

Isograph offers various software for reliability analysis, such as:

Availability Workbench: A system for availability simulation and reliability-centered maintenance RCM. It is used to optimize maintenance and spare parts, predict system availability and throughput, and estimate life-cycle costs. It includes Weibull analysis and life cycle costing modules as well as modeling methods such as FMECA, reliability block diagram analysis, and fault tree analysis.

Reliability Workbench: An integrated visual environment in which failure rate and maintainability prediction, FMECA, reliability allocation, reliability block diagram, fault tree, event tree, and Markov analysis are combined. Failure rate predictions are calculated from the Telcordia, MIL-HDBK-217, 217 Plus, and IEC TR 62380 standards for electronic equipment and the NSWC-98/LE1 Handbook for mechanical parts. FMECA, reliability block diagram, and fault tree analysis are performed to well-known standards such as MIL-STD 1629 and IEC 61508.

Hazop \pm : software for hazard and operability studies, with visual environment using the forms for entering Hazop information. Extensive reporting facilities are available.

More information, including other products, is available at the web site.

PTC Windchill, formerly **Relx Software** (<http://www.ptc.com/product/windchill/quality>)

PTC Windchill Quality Solutions combines quality, reliability, and risk management into an integrated toolset with the following products:

PTC Windchill CAPA: corrects and prevents actions and demonstrates compliance.

PTC Windchill Nonconformance: manages, corrects, and tracks internal quality issues.

PTC Windchill FRACAS: identifies and prioritizes failure-related trends.

PTC Windchill FMEA: identifies and mitigates potential failures.

PTC Windchill MSG-3: manages aircraft reliability according to industry standards.

PTC Windchill FTA: utilizes fault tree analysis to investigate safety and reliability issues.

PTC Windchill Prediction: predicts failure rate of components and system reliability.

PTC Windchill RBD: Reliability Block Diagrams manage quality in complex systems.

PTC Windchill Maintainability: predicts maintenance and repairs.

PTC Windchill LCC: Life Cycle Cost software analyzes the lifetime cost of a product.

PTC Windchill Weibull: Life data analysis or Weibull estimates on the life data of a product.

PTC Windchill ALT : Accelerated Life Testing software predicts product reliability.

PTC Windchill Markov: Visual analysis software that models complex systems.

PTC Windchill Customer Experience Management: reports and manages quality-related field issues.

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